

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Filtration Equipment

We, WALTER MAYER, WOLFGANG KOCH, KARL-ULRICH MEYER-RUDOLPHI and HANS-HEINRICH MESSNER, all of German nationality, trading as Schumacher'sche Fabrik of Bietigheim/Württemberg, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to filtration equipment having a casing divided by a partition into one compartment for unfiltered liquid and one for the filtrate, with at least one filter tube sealed into this partition and retained at its upper end by a circular carrier.

In filtration equipment of this kind, it is difficult to secure ceramic filter tubes in the partition, because the porous material is fragile. For this reason, the carrier employed usually takes the form of fittings which hold the filtration bodies and provide leak-proof but rigid suspension for them in the partition.

Such fittings may have, for example, a supporting rod and carrier plate, on to which the porous filter body is pushed and is retained there by some suitable means. To secure the filter tube thus formed in position, the carrier plate is fitted into a corresponding opening in the partition, so as to form a seal round the rim, the filter body being tightened in the partition by means of a ring attached to the supporting rod and bearing against the opposite side of the opening. Apart from the fact that such filter tubes are awkward and time-consuming to replace in the filter equipment, they are troublesome and expensive to make, especially when the fittings, consisting of steel parts, have to be made acid-resistant by being sheathed in rubber.

In filters of the kind described in the preamble, these drawbacks can now be eliminated according to the invention, in which the carrier is provided as a cylindrical or conical sealing

ring made of resilient material, the inner face of which fits closely to a peripheral portion of the filter tube, which tube, preferably along with all parts secured to it, is fitted loosely into the partition and secured in it by a pressure member acting on the sealing ring. Thus, the resilient sealing ring for which the invention provides takes the place of the whole of the steel fittings, so that the filter tube now consists solely of a ceramic body fitted with the sealing ring. However, not only can the device to which the invention relates be used for filter tubes made of ceramic material, but it is equally suitable for tubes in which the filter body is formed, for example, from a perforated metal cylinder, a perforated or porous plastics material, a filter fabric or sintered metal, if desired surrounded by a filtering medium, such as a filter fabric, a porous plastics material, filter cloth or felt, or by a bonded or unbonded organic or inorganic "fleece".

At the same time, it is simple to secure the filter tube in the partition, since it merely needs to be hung in a corresponding opening in the partition, the sealing ring then serving as a supporting shoulder resting on the rim of the opening. Although the pressure member holds the sealing ring to the appropriate face of the partition, the resilience of the material in the ring allows the filter tube to sway in the partition.

The sealing ring may be secured to the appropriate part of the filter-tube periphery by an adhesive and/or by the tightness with which its inner face fits round the filter tube. This tightness of the sealing ring, for holding and perhaps also for sealing the filter tube, can be simply achieved if the ring be fitted into a holder and compressed within it. Such a holder can be provided, for example, in the form of a circular opening in the partition, into which the ring is inserted and into which it is forced by the pressure member bearing

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on it. Such an arrangement affords the pressure requisite for sealing and securing, in addition to which it offers a simple method of ensuring that the filter tube will be positioned substantially centrally in the appropriate opening in the partition.

Where the filter has a multiplicity of filter tubes fitted in the partition, all these tubes can be secured in place by a common pressure member in the form of a plate, for example, bearing against the end faces of the individual sealing rings, which in that case should preferably project from their holder or holders.

Again, a circular member in the form of a bush on the partition may be provided as a sealing-ring holder. In that case, each sealing ring should form a good fit on the open end of its filter tube, the pressure member with its appropriate openings being placed over the filter tube and forced by some suitable means on to the filter tube and sealing ring. The bush may also be inserted loosely between partition and pressure member or may be secured to one or other of these. Such an arrangement is particularly suitable for filter tubes in which the filter body acts as a support for a surrounding filtering medium, such as, for example, a bonded or unbonded organic or inorganic "fleece", because the well-fitting sealing ring can then act as a means of securing the filtering medium. For the removal of one or more filter tubes as required, the pressure member can be released from the partition and the particular tube or tubes removed from it from the insertion side; or the partition itself can be so fitted as to be removable from the filter casing. With such an arrangement as this, it will be advantageous for the partition to be gripped in a leak-proof flanged joint between the two halves of the casing. No special provision need then be made for the attachment of the partition, which can be removed, together with all its filter tubes, directly the casing is taken apart. In this connection, it will also be helpful to have the pressure member that secures the filter tubes so constructed that it, too, can be readily removed from the partition when the casing is taken apart. Thus, for example, the pressure member may be a flat plate, at least partially pressed round its periphery against the partition by a holding-down member provided inside the appropriate half of the casing.

Filters conforming to the invention are illustrated by way of example in the accompanying drawings, in which:

Figure 1 shows a front elevation, partially broken away, of a filter conforming to the invention;

Figure 2 is a section from Figure 1, shortened and on a larger scale than Figure 1;

Figures 3 and 4 show, partially broken away, a filter conforming to the invention, with modified suspension of the filter tubes

in the partition, the filter bodies of the tubes used here either acting as carriers for a filtering medium or themselves serving as the filtering medium.

The filter shown in Figure 1 has a cylindrical housing in the form of a container consisting of a bottom half 12, and a top half 14, the whole supported on legs 10. These two halves of the container are connected together by bolts 20 passing through flanges 16 and 18 of the halves. For the removal of the top half of the container from the bottom half, lifting mechanism is used, here generally numbered 21, comprising hand-wheel 25 mounted on spindle 23 of the top half of the container, and mounted to pivot with the support tube 27 on the bottom half 12 of the container. Between the two flanges lies partition 26, dividing the container into mixture compartment 22 and filtrate compartment 24, in which partition filter tubes numbered generally 28 are fitted. The tubes 28 are hereinafter described in detail with reference to Figure 2. The liquid that is to be filtered is introduced into mixture compartment 22 through connection 30 (Figure 1) at the bottom of the container. It then passes, after filtration in tubes 28, into filtrate compartment 24, whence it can emerge either through connection 32, provided for the partial evacuation of the filtrate compartment, or through overflow pipe 34.

In the construction illustrated by way of example, the tube filter bodies 40 themselves serve as the filtering medium, being hollow cylinders of ceramic material, and being closed at the end situated within mixture compartment 22. The filter body passes through partition 26, the terminal portion that projects into the filtrate compartment being open-ended. The filter body is secured in the partition by means of sealing ring 42, which at the upper end of the filter body, as shown in Figure 2, is firmly secured to the periphery, for example, by an adhesive and/or by tightness of fit. Sealing ring 42 is inserted for example, in a corresponding circular opening 44 in the partition, and bears against circular shoulder 48, which is formed by this circular opening. The sealing ring of all the filter tubes fitted in the partition plate is compressed by a flat pressure-plate 50, on what (in Figure 2) is the upper face of the partition plate, so that a good seal is produced between the sealing ring on the filter body or filter tubes and the partition. Filter body 40, consisting of ceramic material, passes through both the partition and pressure member 50 with a clearance, so that the resilience of the material in sealing ring 42 allows filter body 40 to sway in the partition.

As can be clearly seen from Figure 2, directly above the upper face of sealing ring 42, there is a radial passage 52 in the filter body, by means of which the filtrate com-

partment can be completely emptied by the filtered liquid flowing into the mixture compartment. For the fitting of partition 26 to the container, parts 54 are hollowed out in the mating faces of flanges 16 and 18 and the partition is of such a diameter that its periphery fits the recesses 54. Thus, as the two halves of the container, 12 and 14, are bolted together, the partition is at the same time anchored in the casing. The construction may be such that during the tightening of the partition, pressure member 50 is tightened at the same time in relation to the partition so securing the filter tubes in place. For this purpose, a holding-down member 56—in the form of a continuous ring, for example—is provided at the inner periphery of the top half 14 of the container, member 56 bearing on the upper side of the pressure member and forcing it down on to the partition or on to the appropriate face of the filter-tube sealing rings as the two halves 12 and 14 of the container are tightened up. The acid-resisting sheath 58, with which all surfaces inside the container are covered, is also clearly to be seen in Figure 2.

In the construction shown by way of example in Figures 3 and 4, container part 74 of the filter, which has an inlet, 70, and an outlet 72, is divided by partition 76 into mixture compartment 78 and filtrate compartment 80.

Partition 76, together with the filter tubes fitted in it and numbered generally 82 and their corresponding means of attachment, form a constructional unit that can be placed in bottom part 74 of the container and firmly secured therein by a tightening device not shown in the drawing. Partition 76 lies, with packing 84, on a supporting shoulder formed by a ring 86, provided inside the container. For the fitting of filter tubes 82, there are merely cylindrical openings 88 in the partition, in which the filter tubes are suspended with a clearance.

The filter tubes are held in place in the partition by a packing ring 90, provided on the filter body and forming a close fit on the open end of the respective filter tube extending into the filtrate compartment. The underside (Figure 3) of the packing ring closes opening 88 in the partition. Packing ring 90 is covered by a bush 92, which lies on the upper side of the partition but is shorter than the packing ring. The projecting part of the packing ring is pressed into the bush by a flat, perforated pressure member 94, which can be tightened to the partition by connection screws 93. This not only seals the filter tubes in the partition, but also holds the packing ring to the filter body.

In the present example (Figure 3), the filter tubes used have a carrier 96, consisting of perforated metal for example, covered by filtering medium 97, which may be, for example, a bonded or unbonded organic or inorganic "fleece". In that case, the sealing ring serves at the same time as a means of attachment for the filtering medium.

In this connection, as Figure 4 shows, with a filter conforming to the invention, filter tubes of other construction may equally well be used—for example, such as have a filter body 98, formed of filtering stone.

WHAT WE CLAIM IS:—

1. A filtering device having a casing divided by a partition into a compartment for the unfiltered liquid and a compartment for the filtrate in which compartment for the unfiltered liquid downwardly directed filter tubes are disposed, the filter tubes each being supported by a supporting device of which the partition is a part, said supporting device having an annular recess open on top in which a sealing ring is arranged whose axial length is greater than the axial length of the annular space and which is compressed by a pressure plate being part of the supporting device in such a manner that it is tightly and holdingly pressed against the outer surface of the filter tube and the inner surface of the recess with the lower face of the sealing ring resting on the partition.
2. A filtering device according to claim 1, in which an annular member in the form of a sleeve is provided that rests with its lower face against the upper surface of the partition and is provided at such a distance from the periphery of the filter tube that the annular recess is provided in which the sealing ring is disposed.
3. A filtering device according to claim 1 or claim 2, in which a pressure plate, common to all the sealing rings, presses against the upper front face of the sealing rings.
4. A filtering device according to any of the preceding claims, in which the sealing ring is secured to the periphery of the filter tube by means of an adhesive.
5. A filtering device according to any of the preceding claims in which that part of the filter tube above the sealing ring and extending into the filtrate compartment is provided with at least one radial passage.
6. A filtering device, substantially as hereinbefore described and illustrated in the accompanying drawings.

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Agents for the Applicants.

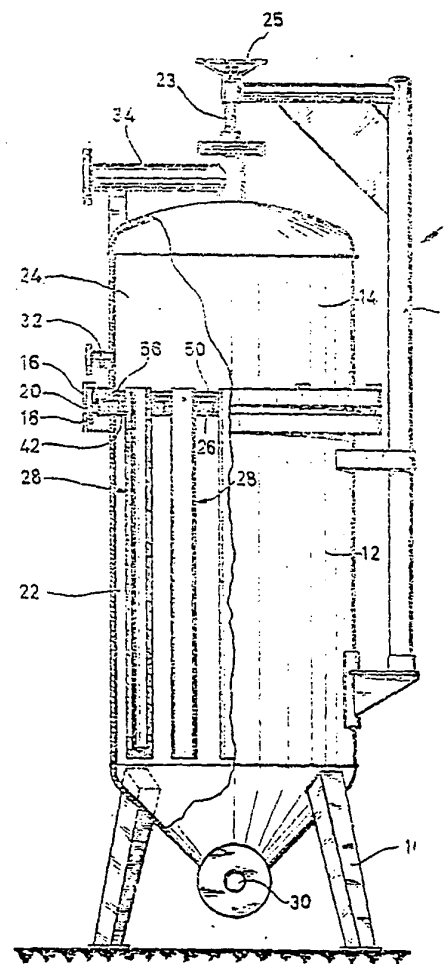


Fig. 1

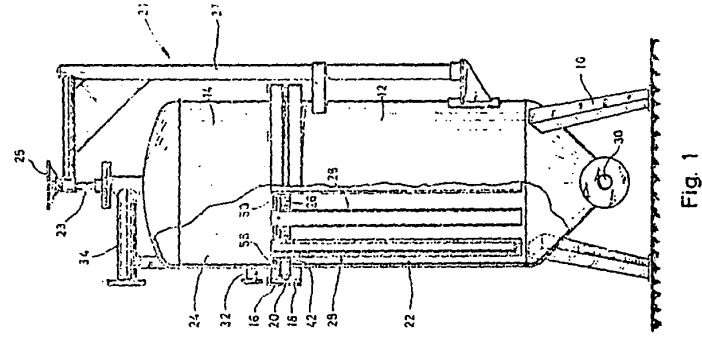


Fig. 1

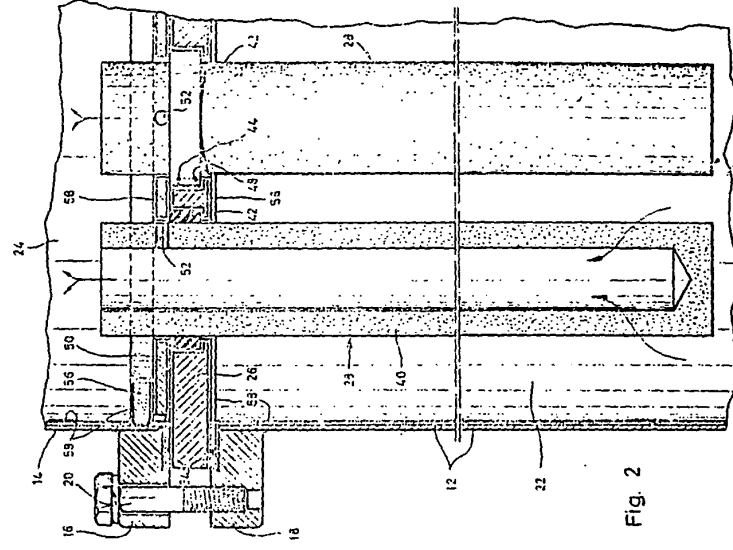


Fig. 2

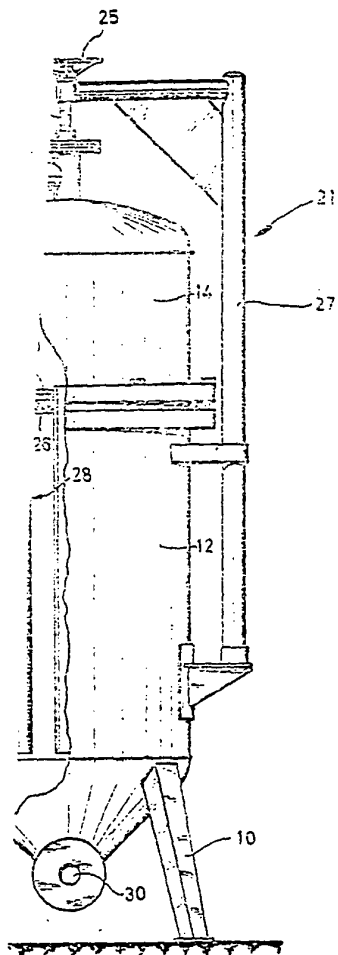


Fig. 1

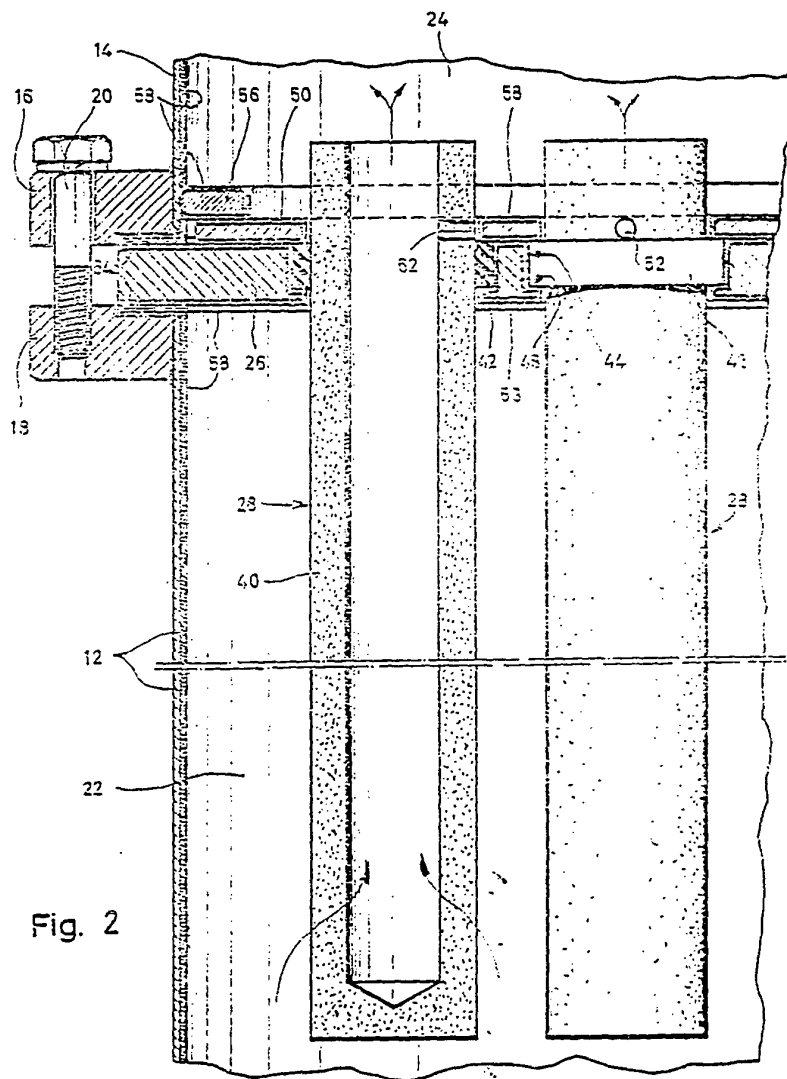
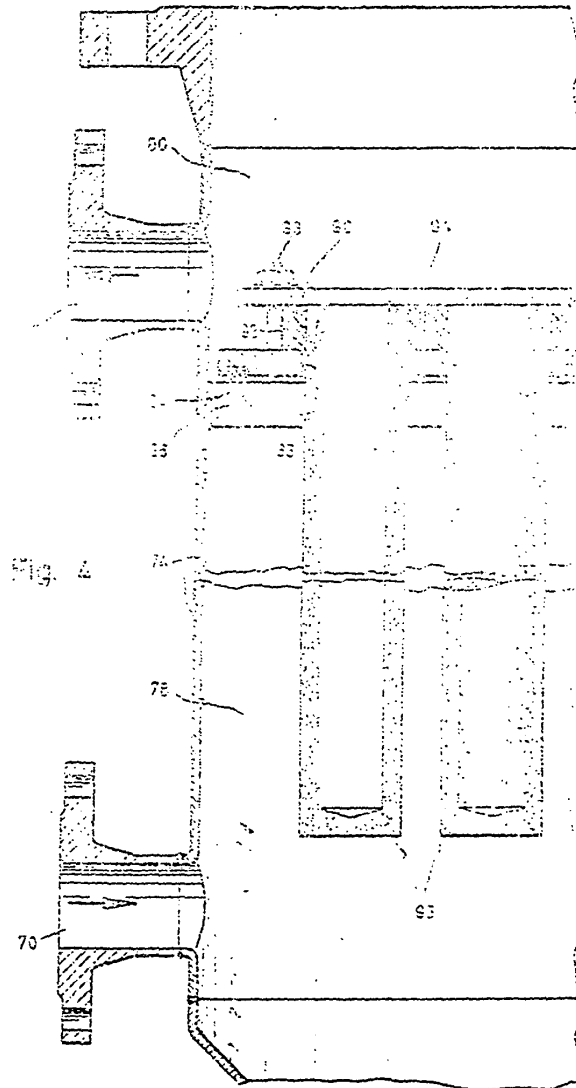
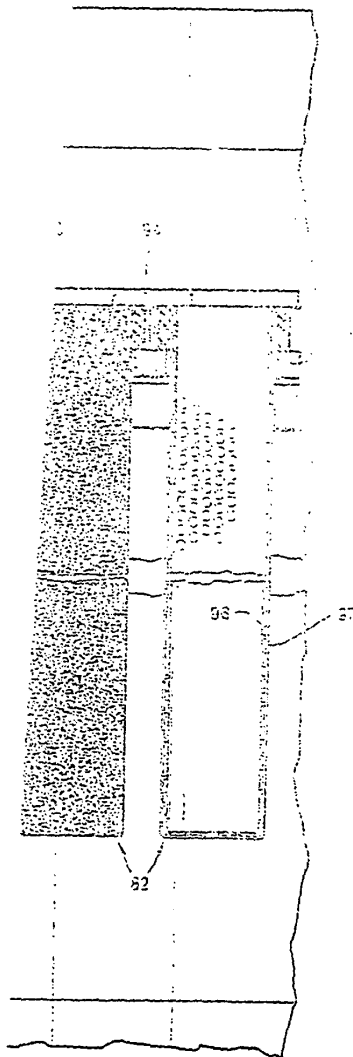
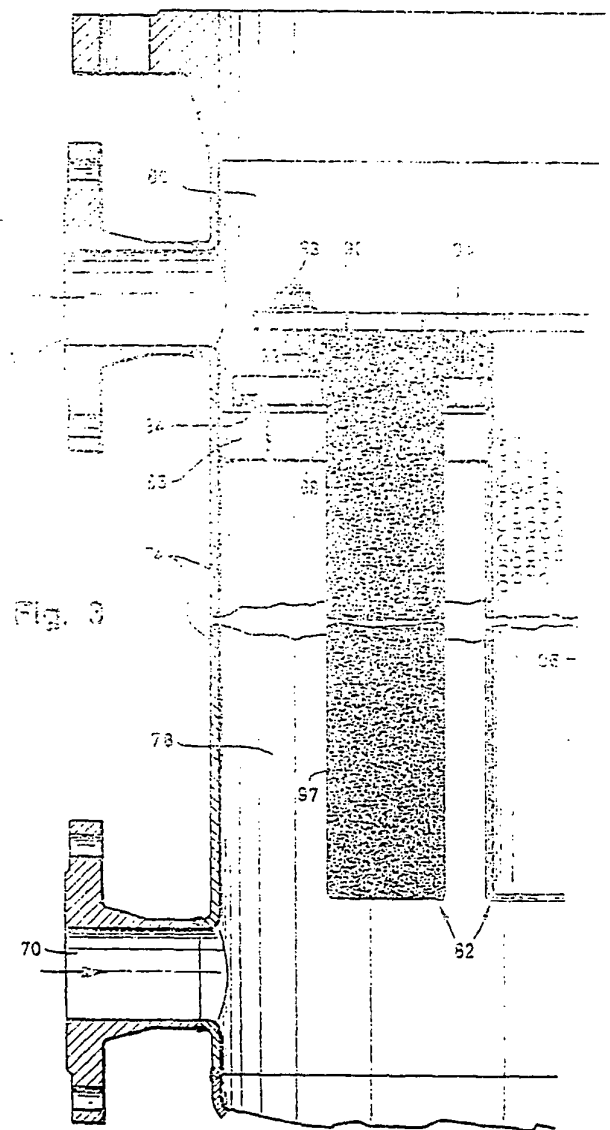


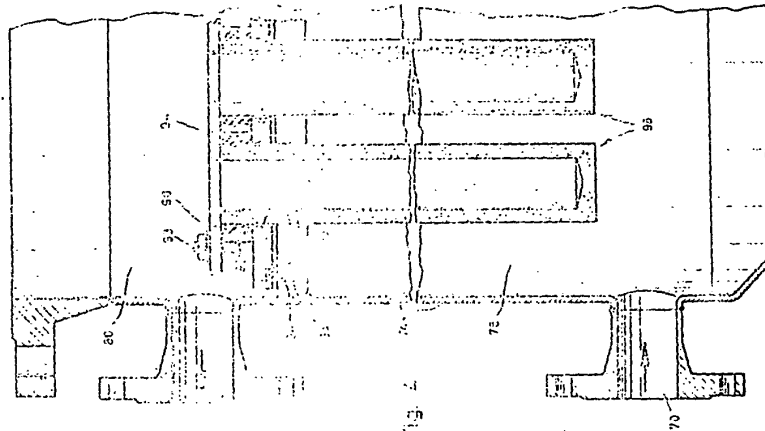
Fig. 2

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 the Original on a reduced scale
 Sheets 3 & 4





2. Heels 3 & 4:



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